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Petrological and geochemical study of doleritic intrusions of Moatize area, Tete Province, Mozambique

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The dolerite samples studied in this work are part of drilling cores, obtained during exploration campaigns by the Ncondezi Coal Company, in the prospect area 805L, located at NE of Moatize, Tete Province, Mozambique.
The dolerite bodies are intrusive into sedimentary formations of the Karoo Supergroup. The intrusions have a probable Jurassic age, around 180 Ma, based on a geochronological information (GTK Consortium, 2006) from a similar body cropping out in another area of the Tete Province.
The studied rocks were affected by hydrothermal alteration, testified by the pervasive occurrence of the assemblage serpentine + chlorite + sericite + sphene + calcite $\pm$ epidote $\pm$ tremolite-actinolite, and by filling of vesicles and fractures by calcite, pyrite or calcite + pyrite $\pm$ quartz. However, the selected samples preserve igneous intergranular textures. Petrographic evidence suggests that the primary mineral associations included plagioclase, titanaugite, olivine, apatite, opaques, biotite and hornblende. These assemblages are variably preserved and, in the samples most intensely altered, the igneous minerals were almost totally replaced.
Whole-rock major and trace element data, with particular emphasis on immobile elements, indicate that the analysed samples are basic and that they can be seen as cogenetic, belonging to the alkaline series and showing compositions similar to present-day intraplate basalts.
The Rb-Sr and Sm-Nd data seem to confirm the cogenetic nature of the studied dolerites. In fact, in the least altered samples, both [87Sr/86Sr]180Ma and εNd180Ma define relatively small ranges: +0.7050 $\geq$ [87Sr/86Sr]180Ma $\geq$ 0.7038 +10 $\geq$ εSr180Ma $\geq$ -7 and +3.6 $\geq$ εNd180Ma $\geq$ +1.7. In addition, this clearly indicates that parental melts were generated in a mantle source and that magmas did not undergo significant crustal contamination during their ascent and emplacement. The described isotopic compositions, besides plotting in an area common to OIB, are similar to those found in igneous rocks related to the rifting process in Tanzania and Kenya.
Samples that were more intensely affected by hydrothermal alteration display similar εNd180Ma values, but show more radiogenic Sr signatures (up to [87Sr/86Sr]180Ma = 0.7063). This indicates a significant crustal contribution in the aqueous fluids responsible for the hydrothermal processes.
The whole set of obtained data is in agreement with a magmatic event related with the activity of a mantle plume which caused not only a thermal effect but also geochemical enrichment in the mantle source of the parental magmas of the studied rocks.

Reference:
GTK Consortium (2006). Map Explanation; Volume 1: Sheets 2032 – 2632. Direcção Nacional de Geologia de Moçambique, Maputo, 341 pp.

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